(19) Patent office of Japan (JP) (11) Publication of Patent Application

(12) **JAPANESE PATENT Application Laid Open (KOKAI) (A)**
Hei-Sei 10-71572

(51) Int. CL.5 ID Code Office Cont'l Nbr. (43) Publication: Hei-Sei 10 (1998) 3/17

F1

B 24 D 11/00 B

3/00 310 9/00 310 Z

Verification Request: not requested

Number of claims of the invention: 10 FD

Number of pages (8)

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(54) Name of the invention: Polishing Tape and Its Manufacturing Method

(21) Filed Number: Hei-sei 8-243978

(22) Filed date: Hei-sei 8 (1996) 8/28

Patent Assignee: Dai Nippon Insatsu Company

JP 10-71572

[Note : Names, addresses, Company names and brand names are translated in the most common manner. Japanese Language does not have singular or plural words unless otherwise specified with numeral prefix or general form of plurality suffix. Translator's note.]

(54) [Name of the invention]

Polishing Tape and Its Manufacturing Method

(57) [Summary]

[Topic]

To suggest a polishing tape that is polishing tape for precise parts and where at the time of the polishing there are no polishing scratches and it is a polishing tape that has durability properties and is appropriate for final finish treatment.

[Solution measures]

It is a polishing tape that is the polishing tape 4 with a structure, where on one side of the substrate material film 5, a primer layer 6 is provided and a polishing layer 7 is provided, that has a center line surface roughness Ra in the range of 0.005 ~ 2.0 microns, and where the total light beam permeability is in the range of 50 ~ 90 %, and also where the haze value is in the range of 5 ~ 70 %; and this polishing layer has a structure formed from a composite oxide, where the average particle size of the abrasive material particles is in the range of 10 ~ 700 nm, and a binder material.

[Range of the claims of the invention]

[Claim 1]

Polishing tape, characterized by the fact that is a polishing tape with a structure, where on one side of the substrate material film, a primer layer is provided and a polishing layer is provided, that has a center line surface roughness Ra in the range of 0.005 ~ 2.0 microns, and where the total light beam permeability is in the range of 50 ~ 90 %, and also where the haze value is in the range of 5 ~ 70 %; and this polishing layer has a structure formed from a composite oxide, where the average particle size of the abrasive material particles is in the range of 10 ~ 700 nm, and a

binder material.

[Claim 2]

Polishing tape according to the above described Claim 1 of the present invention, characterized by the fact that the above described composite oxide particles are alumina - silica composite oxide particles.

[Claim 3]

Polishing tape according to the above described Claim 1 and Claim 2 of the present invention, characterized by the fact that the above described alumina - silica composite oxide particles are spherical shape particles that have as their main component a mullite phase.

[Claim 4]

Polishing tape according to the above described Claim 1 through Claim 3 of the present invention, characterized by the fact that the above described binder material is an organic and/or inorganic composite resin material, or organopolysiloxane etc., siloxane bond containing silicone type resin material.

[Claim 5]

Polishing tape according to the above described Claim 1 through Claim 4 of the present invention, characterized by the fact that the above described substrate material film is a polyester film with a film thickness in the range of 50 through 100 microns.

[Claim 6]

Polishing tape according to any of the above described Claim 1 through Claim 5 of the present invention, characterized by the fact that the primer layer that is provided on the above described substrate material film, is a biaxially oriented film that is formed as on either a nonoriented or uniaxially oriented film, a primer layer coating solution is coated, and dried, and after that, especially, it is oriented and it is subjected to a thermal fixing technological process, and the adhesion between the substrate material film and the above described primer layer, is reinforced.

[Claim 7]

Polishing tape, characterized by the fact that, the coating solution for the formation of the polishing layer reported according to the above described Claim 1 through Claim 6 of the present invention, is formed from polishing material particles, where the average particle diameter when it is wetted by a solvent agent or dispersed, is in

the range of 10 ~ 700 nm, and a binder material, that is dissolved in a solvent agent used for the coating technological process, and also, the weight ratio of the above described polishing material particles and the binder material, is in the range from 20 : 80 through 90 : 10, and by that the structure is formed, and the above described coating solution is coated on the substrate material film.

[Claim 8]

Manufacturing method for the preparation of a polishing tape, characterized by the fact that the polishing layer that has been reported according to the above described Claim 1 through Claim 6 of the present invention, is obtained as the coating solution that is reported according to the above described Claim 7 of the present invention, is passed through a filter from 2 to 10 microns, and after that, it is coated by using a coating part, under an ambient environment at a temperature in the range from 30 to 40oC, where the relative humidity that occurs at these same temperatures, is from 30 to 80 %, and it is dried, solidified and cured.

[Claim 9]

Manufacturing method for the preparation of a polishing tape, according to the above described Claim 8 of the present invention, characterized by the fact that the polishing layer reported according to the above described Claims 1 through 7 of the present invention, is coated by using a gravure reverse coating technological process.

[Claim 10]

Manufacturing method for the preparation of a polishing tape, according to the above described Claim 8 or Claim 9 of the present invention, characterized by the fact that the
polishing layer reported according to the above described Claims 1 through 7 of the present invention, is coated by a coating technological process, dried and solidified and after that, especially, by a thermal treatment conducted at a temperature of 100oC, for 10 minutes or more, the cure reaction is completed.

[Detailed explanation of the invention]

[0001]

[Technological sphere pertinent to the present invention]

The present invention is an invention about a polishing tape that is used in order to conduct the final finishing of the front surface or the edge surfaces of precision part products, like optical connector ferrules, semiconductor wafers, ceramics, color filters used for liquid crystal displays, plasma displays, optical glass, optical lenses,

magnetic discs or optical discs substrate plates, magnetic heads, optical reading heads, etc. And the present invention is also an invention about the manufacturing method of that polishing tape and the preparation of the coating solution used for the polishing tape.

[0002]

[Previous technology]

Regarding the optical fibers and semiconductor wafers, by the precision of the polishing technological process that performs the final mirror surface finish, the quality of this product varies, and a final finishing polishing treatment called mechanical polishing is conducted by using at the same time together a polishing solution and a polishing fabric. Then, regarding the method for the use of the above described polishing solution, the polishing technological process becomes a complex process, and as a method in order to circumvent that, the method where a polishing tape is used, has been conceived. This polishing tape is a tape where relative to a substrate material film used in polishing tapes, that is mainly formed from plastic materials, a coating solution is coated, and dried and by that the polishing layer is formed. And in this case, the coating solution is obtained as abrasive material particles are dispersed in a varnish that is obtained as a binder material is dissolved in a solvent agent appropriate for the coating technological process (It is a material used in order to fix the abrasive material particles onto the substrate material film, and it has a structure formed from a synthetic, natural resins, plasticizing agents, lubricating agents, antielectrostatic agents, etc.).

[0003]

[Problems solved by the present invention]

As the abrasive material particles of the polishing tapes, silica and alumina have been used. However, in the case of the silica, its hardness is worse than that of the alumina, and from the point of view of the polishing efficiency, it is a material that is not satisfactory. On the other hand, the alumina is obtained as an agglomerated body of microscopic, fine brush shaped particles, and because of that, at the time of the polishing (grinding), there is the problem that fine polishing scratches are generated.

[0004]

Regarding the present invention, it is an invention that has taken into consideration the above described drawback points and problem points, and it is an invention that has as a topic to suggest a polishing tape where there is no generation of polishing scratches and where the polishing efficiency is good, and that is polishing tape that can be used for the conducting of a precise final finish treatment

of the mirror surfaces of the precise part products, like the edge surfaces of the optical connector ferrules, the front surfaces of the semiconductor wafers, etc. and it is an invention suggesting its manufacturing method.

[0005]

[Measures in order to solve the problems]

In order to solve the above described problems, the tape according to the present invention, that is used for the polishing of precision part products, is a polishing tape, characterized by the fact that it has a structure, where on one side of the substrate material film, a primer layer is provided and a polishing layer is provided, that has a center line surface roughness Ra in the range of 0.005 ~ 2.0 microns, and where the total light beam permeability is in the range of 50 ~ 90 %, and also where the haze value is in the range of 5 ~ 70 %; and this polishing layer has a structure formed from a composite oxide, where the average particle size of the abrasive material particles is in the range of 10 ~ 700 nm, and a binder material. Then, it is a polishing tape where the above described composite oxide particles, are alumina - silica composite oxide particles. Also, it is a polishing tape where the above described alumina - silica composite oxide particles are spherical shape particles that have as their main component a mullite phase. Then, it is a polishing tape where the above described binder material is an organic and/or inorganic composite resin material, or an organopolysiloxane etc., siloxane bond containing silicone type resin. And also, it is a polishing tape according to the above described Claim 1 through Claim 4 of the present invention, where the above described substrate material film is a polyester film with a thickness in the range of 50 ~ 100 microns. Then, it is a polishing tape where the primer layer that is provided on the above described substrate material film, is a biaxially oriented film that is formed as on either a nonoriented or uniaxially oriented film, a primer layer coating solution is coated, and dried, and after that, especially, it is oriented and it is subjected to a thermal fixing technological process, and the adhesion between the substrate material film and the above described primer layer, is reinforced. Also, it is a polishing tape, where the coating solution for the formation of the polishing layer, is formed from polishing material particles, where the average particle diameter when it is wetted by a solvent agent or dispersed, is in the range of 10 ~ 700 nm, and a binder material, that is dissolved in a solvent agent used for the coating technological process, and also, the weight ratio of the above described polishing material particles and the binder material, is in the range from 20 : 80 through 90 : 10, and by that the structure is formed, and the above described coating solution is coated on the substrate material film.

[0006]

It is a manufacturing method for the preparation of a polishing tape, where the polishing layer, is obtained as the above described coating solution is passed through

a filter from 2 to 10 microns, and after that, it is coated by using a coating part, under an ambient environment at a temperature in the range from 30 to 40oC, where the relative humidity that occurs at these same temperatures, is from 30 to 80 %, and it is dried, solidified and cured. Also, it is a manufacturing method for the preparation of a polishing tape, where the polishing layer reported here above, is coated by using a gravure reverse coating technological process. And it is a manufacturing method for the preparation of a polishing tape, where the polishing layer reported here above, is coated by a coating technological process, dried and solidified and after that, especially, by a thermal treatment conducted at a temperature of 100oC, for 10 minutes or more, the cure reaction is completed.

[0007]

Regarding the alumina - silica composite oxide particles, according to the present invention, they are particles with a spherical shape that have mullite phase as their main component, and they contain the mullite phase that has one type of crystallized glass structure, and then, it is a composite oxide material where its chemical composition is represented by 3 Al2O3 . 2 SiO2. Because of the fine structure it is a ceramic material that has excellent thermal resistance properties (the optimum use temperature is approximately 1500oC), electrical insulation properties, and mechanical strength properties. Then, if iron, titanium oxides are contained, there is the trend that the refraction index is increased. It is a material that is obtained as metal powder etc., is thermally sintered and synthesized in an oxidizing air flow, and by that it is produced as a composite oxide material, and among these types of materials, the materials where the average particle diameter is in the range of 10 ~ 700 nm, and where the particles have a shape close to a spherical shape, are used in the preparation of the polishing tape.

[0008]

Also, regarding the spherical shape particles that have mullite phase as their main component, it is possible to use the particles that have a spherical structure and that are formed from "alumina - silica composite oxide material". Regarding the spherically shaped particles, they include the particles with a spherical shape and it is also a good option if in that definition, the particles are included that have a smooth curved surface so that the shape is close to an ellipse shape non-flat shape. Especially, spherical particles are preferred that do not have the so-called cutting edges, like protrusions or corners at the surface. Also, regarding the mullite phase type alumina - silica composite oxide particles, when they are used as the abrasive material particles, they indicate particles that have a spherical shape, dense structure where the amorphous silica and the alumina with the brush shaped particles, become different. And regarding their Mohs hardness, it is a value that indicates that it is harder than the silica Mohs hardness of 6 and it is a value that is close to the Mohs hardness of the alumina, which is 11. Also, regarding the temperature of its thermal resistance, it is a material that presents a temperature of 1500oC, which is

higher than that of the silica at 1000oC and that of the alumina of 1100oC.

[0009]

[Conditions of the practical implementation of the present invention]

Regarding the polishing tape 4 according to the present invention, as it is sown according to Figure 1, it is a polishing tape 4, that has a structure, where on one side of the substrate material film, a primer layer is provided and a polishing layer is provided, that has a center line surface roughness Ra in the range of 0.005 ~ 2.0 microns, and where the total light beam permeability is in the range of 50 ~ 90 %, and also where the haze value is in the range of 5 ~ 70 %, and it is close to a mirror surface. Then, this polishing layer has a structure formed from a composite oxide, where the average particle size of the abrasive material particles is in the range of 10 ~ 700 nm, and a binder material.

[0010]

Regarding the substrate material film of the polishing tape according to the present invention, it is possible to be appropriately selected from the films that have a strength that is sufficiently resistant to the polishing operation, and that has a strength to resist relative to the coating and drying of the polishing material, also that has thermal resistance properties, and were there is only a small dimensional change when it is laminated with a protective film as a laminated layer. For example, it is possible to use the following: oriented or unoriented films formed from high density polyethylene, polypropylene etc., polyolefin type resins, polystyrene, polyvinyl chloride, polyvinylidene chloride, polyvinyl alcohol, ethylene - vinyl alcohol copolymer materials, polyacrylonitrile, polyamide, acrylic resins containing as their main components acrylic acid esters or methacrylic acid esters, polyethylene terephthalate, polyethylene naphthalate, etc., polyesters, polyacetal, di or tri- cellulose acetal, fiber type derivative materials, and polycarbonate etc.

[0011]

On the substrate material film, in order to prevent the adhesion of powder dust it is preferred that an antielectrostatic agent is added. Regarding the antielectrostatic agent, it is possible to add the appropriately selected materials from the usually used nonionic type surface active agents, anionic type surface active agents, cationic type surface active agents, etc., polyamide derivative materials, and acrylic acid derivative materials, etc.

[0012]

Especially, the following materials can be selected: polyethylene terephthalate film

that has appropriate properties for the coating of the polishing layer, appropriate properties for the post processing, and excellent exploitation of the polishing structure, Nylon 66 biaxially oriented film and polyimide film with a thickness in the range of 12 ~ 100 microns. Then, on the side where the primer layer or the polishing layer have been coated, it is preferred that a treatment for easy adhesion treatment is conducted like a corona electrical discharge treatment, ozone gas treatment, etc. Regarding the preferred substrate material film, it is the polyester film that has many types and that is easy to modify, and especially, it is the film obtained as a polyethylene terephthalate biaxially oriented film that has thermal resistance properties and rigid properties and another polyester with a thickness in the range of 50 ~ 100 microns, that is provided as a primer layer.

[0013]

Regarding the primer layer according to the present invention, it varies depending on the type of the substrate material film, however, it is obtained as varnishes that have as their main components, vinyl chloride - vinyl acetate type copolymer material, polyvinyl acetate, polyvinyl alcohol type resin, polyvinyl acetal type resin, polyalkyl acrylate, and polyalkyl methacrylate etc., acrylic type resins, ethylene type copolymer materials, rubber type derivative materials, polyester type resins, polyamide type resins, phenol type resins, epoxy type resins, aminoplast, polyurethane type resins, silicone type resins, cellulose derivative materials, etc., are coated on a nonoriented film or uniaxially oriented film, and after that, especially, the biaxial orientation technological process is conducted, and the adhesive strength in the space between the substrate material film and the primer layer is reinforced, or it is simply coated on the oriented film material.

[0014]

In order to stabilize the strength of the adhesion between the polishing layer and the substrate material film, the provided primer layer is a varnish made from a material that is the same type as the above described binder material, and besides that, as the primer layer, even if it is a layer that has insignificant adhesive properties, it is capable of preventing the blocking by the polishing layer. Consequently, it is also possible to select from materials that have affinity properties to the substrate material film, and have strong adhesive force and low glass transition points. Then, depending on the type of these varnishes, it is also possible that isocyanate etc., curing agent is added and by that it is possible to reinforce the adhesion.

[0015]

Regarding the primer layer, by the coating on an unoriented film or on a uniaxially oriented film, and after that conducting an orientation technological process, the primer layer is thermally adhered onto the film, and it is possible to reinforce the adhesion between the substrate material film and the primer layer. Also, regarding

the primer layer, it is not necessarily only formed by a coating technological process, but also, it is possible to be formed by a coextruded film orientation technological process. For example, as it is seen by looking at polyethylene terephthalate and linear type polyester (for example, polyester where the secondary transition point Tg is in the range of 40 ~ 130oC), or polypropylene and ethylene - vinyl acetate copolymer material they have different crystallization temperatures (lower) compared to the resins that form the substrate film materials, and by orienting the layer that has been manufactured by the coextrusion with the resin material, that becomes the primer layer, it is possible to form a substrate material film that has a precise thickness and where the adhesion relative to the polishing layer is stabilized.

[0016]

Regarding the abrasive material particles, they are particles that are different from the amorphous silica and the brush shaped particle alumina, and they have as their main component mullite phase, that is formed from particles that have an almost spherical shape structure (alumina - silica composite oxide material". From the point of view of the use in a polishing tape that is appropriate for a polishing material employed in precision part products, the materials are preferred, that have primary particles with a spherical shape, in the range of 10 ~ 700 nm. Usually, the smaller the diameter of the particles of the abrasive material, it is necessary that the contained amount that can be compounded in the coating solution, is high, and when the diameter of the particles is large, it is necessary that the contained amount is low. Then, at the time when the diameter is less than 10 nm, it is not possible to obtain polishing (grinding) results. And at the time when the particle diameter is higher than 700 nm, it is a material whereby scratches are imparted onto the subject to polishing material. Consequently, it is possible to preferably use composite oxide material particles with an almost spherical shape where the diameter is in the range of 10 ~ 700 nm.

[0017]

Then, in order to homogeneously disperse the ultrafine particles, that have an average particle size in the range of 10 ~ 700 nm, in the varnish that has viscous properties, for example, the alumina - silica composite oxide material particles are are wetted by using isopropyl alcohol, etc., solvent agent, they are mixed with an added nonionic surface active agent or an anionic surface active agent, and a coating solution is prepared, and it is possible to conduct the operation without having agglomeration of the 10 ~ 700 nm particles in the coating solution. Preferably, to the solvent agent wetted, sufficiently dispersed abrasive material particles, are sufficiently dispersed, and especially, they are sufficiently dispersed while the solvent agent is being added in small amounts, and it is homogeneously stirred, and the binder material that has been dissolved in a solvent agent, is added in small amounts and at the same time, it is sufficiently stirred, and a coating solution in a good dispersion state is prepared. Regarding the prepared coating solution, it is

preferred that a filtration is conducted through a 2 ~ 10 micron filter, and the re-agglomerated abrasive material particles because of sedimentation etc., are eliminated and after that this is supplied to the coating technological process.

[0018]

In order to harden the organic - inorganic composite polymer material of the polishing layer, it is also possible to prepare a coating solution where organometallic compounds are added, like zinc, manganese, zirconium, lantanum, tin, etc.

[0019]

Regarding the binder according to the present invention, it is possible to use organic and inorganic composite resin material, or prepolymer, oligomer, or polymer, that contain a siloxane bond [siloxane bond: (- Si - O -)n] in their structure, etc. Then, polysiloxane and its derivative materials, or modified materials, or their blended materials, etc., can be used.

[0020]

In more details, the monomer that forms the structure of the polysiloxane, prepolymer, or oligomer or polymer, are mixed or reacted with monomers, prepolymers or oligomers or polymers of for example, acrylic type resins, polyethylene type resins, polyvinyl chloride resins, polyvinyl acetate type resins, polyvinyl alcohol type resins, polyvinyl acetal type resins, rubber type polymers, polyester type resins, polyamide type resins, phenol type resins, aminoplast, epoxy type resins, polyurethane type resins, cellulose derivative materials, etc., and it is possible to use these blended materials or materials synthesized from these reactions. Then, the amount added of the curing agent, relative to the organic - inorganic composite resin material, is in the range of 0.0001 ~ 35 weight % (solids ratio).

[0021]

Especially, according to the present invention, it is preferred to use the organic - inorganic composite polymer materials or their prepolymers, or oligomers etc., that are obtained as polyethylene type resin, polyvinyl chloride type resin, polyvinyl acetate type resin, acrylic type resin, polyurethane type resin, polyester type resin, etc., prepolymers, or oligomers or polymers are used as the main chain, and as the side chains, polysiloxane prepolymers, or oligomers or polymers, for example, are reacted by a graft polymerization, and the main chain part has a structure formed from an organic type compound, and the side chain part has a structure formed from an inorganic properties possessing compound that is formed by the siloxane bond, etc. By the use of the above described organic - inorganic composite resin polymer material as the binder material for the polishing layer, there is no partial

agglomeration of the abrasive material particles inside the coating solution or inside the polishing layer, and it is a material whereby it is possible to obtain a homogeneous coating technological process, and it is possible to form the structure of a polishing tape that is appropriate for ultrafine polishing of precise parts products.

[0022]

Regarding the weight ratio of the alumina - silica composite oxide particles and the binder (organic - inorganic composite polymer), in the coating process solution, it is desirable that it is in the range of 20 : 80 ~ 90 : 10. In the case when the particle ratio exceeds 90 weight %, it is easy for the particles to fall off, and at the time when it is less than 20 weight %, it is not possible to demonstrate the polishing effect.

[0023]

By using a coating solution that has a structure formed, so that the weight ratio of the wetted in a solvent agent as it has been described here above, 10 ~ 700 nm size, alumina - silica composite oxide particles, and the binder material (organic - inorganic composite polymer material), is in the range of 20 : 80 ~ 90 : 10, a polishing tape is produced. Namely, as it is shown according to Figure 1, as the substrate material film 5, for example, a polyethylene terephthalate film with a thickness in the range of 10 ~ 200 microns, and preferably, in the range of 50 ~ 100 microns, is used, and on one side of that, depending on the requirements, a primer layer 6 of the substrate film, is provided that has as its main component an epoxy resin, an acrylic resin or polyester etc.

[0024]

After that, by suing an indented shape doctor, it is possible to evenly stabilize and regulate the amount for the coating technological process, and by the reverse gravure method, that uses a gravure shape, a coating layer is provided at an amount in the range of 0.5 ~ 10 g/m2 (in this detailed description of the present invention, the coating process amounts are expressed as solids grams/m2), and preferably, it is in the range of 3 ~ 5 g/m2, and it is coated, dried and then solidified. Also, regarding the siloxane bond containing binder used according to the present invention, it is a material where by the temperature and the humidity, the cure reaction is continued. Consequently, regarding the ambient atmosphere at the time of the coating technological process, it is preferred to be conducted at the possible limit higher temperature and at a high humidity. However, at the time when the high temperature and the high humidity become extreme, the coating process solution is solidified at the surface of the gravure form, and the cure reaction of the coated polishing layer becomes uneven, and the coating solution undergoes a polycondensation reaction prior to the coating process, and there is the problem that there is a generation of gel type materials. Consequently, the temperature in the

range of 30 ~ 40oC, and at the same temperatures, a relative humidity in the range of 30 ~ 80 %, are preferred conditions. Especially, with the goal to complete the reaction, by conducting a thermal treatment at temperatures in the range of 80 ~ 120oC, that corresponds to a treatment at a temperature of 100oC for 10 minutes, the cure reaction is completed homogeneously, and it is possible to form a structure of the polishing layer that has durability properties.

[0025]

Regarding the center line average roughness Ra, of the front surface of the produced by that polishing tape,when it is in the range of 0.005 ~ 2.0 microns, it is possible to form a structure of a polishing tape that is appropriate as a polishing layer for the polishing of precise parts products. Then, by the act that a primer layer has been provided, there is a cushioning effect and because of that, it is possible to obtain a structure of a polishing tape that is appropriate for the polishing of precise parts products, where there is no generation of polishing scratches on the surface of the material that is being polished, and where the polishing coefficient is increased and it is a polishing tape that has durability properties.

[0026]

Regarding the above described polishing tape, as it is shown according to the presented in Figure 2, on a supporting body 9, that is formed from a rotating metal plate, the elastic elastomer is provided, and then the polishing tape 4 according to the present invention, is placed. Regarding the polishing procedures, on the top of the polishing tape 4, the edge surface of an optical connector ferrule, except the part 3, that is covered by the optical fiber 2, is polished for a period of approximately 30 ~ 60 seconds. Regarding the polishing tape according to the present invention, that uses alumina - silica composite oxide particles, it is a tape whereby there is no generation of polishing scratches on the surface that is being polished and the polishing is conducted at a good efficiency.

[0027]

Here below, the present invention will be explained in more details, by using practical examples.

[Practical Examples]

[Practical Examples 1 ~ 3]

Ceramic coat material according to the composition shown in Table 1 (organic - inorganic composite polymer silicone varnish) and wetted in isopropyl alcohol mullite phase alumina - silica composite oxide material particles, with an average particle diameter in the range of 500 ~ 700 nm, were used as the main components,

and the coating process solutions used for the preparation of the polishing layers according to the Practical Example 1, 2 and 3, were produced. After that, by the film manufacturing technological process, the shown in Figure 1, 75 micron thick primer layer 6, was provided at the time of the orientation technological process of the manufactured film material, and an easy adhesion properties possessing polyethylene terephthalate film was used as the substrate material film 5, and on this primer layer 6, each of the above described coating process solutions, after they have undergone a filtration at 5 microns, were reverse gravure coated by using a tilted line indented form, under an ambient atmosphere of 35oC and a relative humidity of 40 %, and the coated amount was 9 g/m2, then this was dried and solidified, and especially, at a temperature of 100oC a thermal treatment was conducted for a period o 10 minutes, and by that the polishing tapes 4, according to the Practical Examples 1 ~ 3, were obtained.

[0028]

(Practical Example 4 ~ 6)

As the substrate material film 5, 75 micron thick polyester (easy adhesion properties possessing polyethylene terephthalate film) was used and on the side where a corona electrical discharge treatment as been conducted for an easy adhesion, an epoxy type primer layer was reverse gravure coated at an amount of 1 g/m2, and by that the primer layer 6, was formed. After that, the coating solutions used according to the above described Practical Examples 1 ~ 3, after they have undergone the same filtration as described according to the Practical Example 1, were reverse gravure coated by using a tilted line indented form, under an ambient atmosphere of 35oC and a relative humidity of 40 %, and the coated amount was 9 g/m2, then this was dried and solidified, and especially, at a temperature of 100oC a thermal treatment was conducted for a period o 10 minutes, and by that the polishing tapes 4, according to the Practical Examples 4 ~ 6, were obtained.

[0029]

(Practical Examples 7 ~ 9)

Ceramic coat material according to the composition shown in Table 1 (organic - inorganic composite polymer silicone varnish) and wetted in isopropyl alcohol mullite phase alumina - silica composite oxide material particles, with an average particle diameter in the range of 70 ~ 120 nm, were used as the main components, and the coating process solutions used for the preparation of the polishing layers according to the Practical Example 7, 8 and 9, were produced. After that, on the primer layer 6 of the same substrate material film as that used according to the above described Practical Example 1, each of the above described coating process solutions, after they have undergone a filtration according to the described in the Practical Example 1, were reverse gravure coated by using a tilted line indented

form, under an ambient atmosphere of 35oC and a relative humidity of 40 %, and the coated amount was 6 g/m2, then this was dried and solidified, and especially, at a temperature of 100oC a thermal treatment was conducted for a period of 10 minutes, and by that the polishing tapes 4, according to the Practical Examples 7 ~ 9, were obtained.

[0030]

(Practical Example 10)

Ceramic coat material according to the composition shown in Table 1 (organic - inorganic composite polymer silicone varnish) and wetted in isopropyl alcohol mullite phase alumina - silica composite oxide material particles, with an average particle diameter in the range of 70 ~ 120 nm, were used as the main components, and the coating process solutions used for the preparation of the polishing layers according to the Practical Example 10 was produced. After that, on the primer layer 6 of the same substrate material film with the applied primer layer, as that used according to the above described Practical Example 1, the above described coating process solution, after it has undergone a filtration according to the described in the Practical Example 1, was reverse gravure coated by using a tilted line indented form, under an ambient atmosphere of 35oC and a relative humidity of 40 %, and the coated amount was 6 g/m2, then this was dried and solidified, and especially, at a temperature of 100oC a thermal treatment was conducted for a period of 10 minutes, and by that the polishing tape 4, according to the Practical Example 10, was obtained.

[0031]

(Practical Example 11)

Ceramic coat material according to the composition shown in Table 1 (organic - inorganic composite polymer silicone varnish) and wetted in isopropyl alcohol mullite phase alumina - silica composite oxide material particles, with an average particle diameter in the range of 70 ~ 120 nm, were used as the main components, and ammonium hydroxide was added and by that the pH was adjusted to a pH of 7, and by that the coating process solution used for the preparation of the polishing layers according to the Practical Example 11 was produced. After that, on the surface of the 75 micron thick polyester film the primer used according to the Practical Example 4, was used, and a primer was coated, and by that the primer layer 6 was provided, and the above described coating process solution, was reverse gravure coated by using a 3 reverse roll coating, so that the coated amount was 30 g/m2, then this was dried and solidified, and especially, at a temperature of 100oC a thermal treatment was conducted for a period of 10 minutes, and by that the polishing tape 4, according to the Practical Example 11, was obtained.

[0032]

(Reference Examples)

[Reference Example 1]

Ceramic coat material according to the composition shown in Table 1 (organic - inorganic composite polymer silicone varnish) and organo-silica sol material particles, with an average particle diameter in the range of 70 ~ 120 nm, were used as the main components, and by that the coating process solutions used for the preparation of the polishing layers according to the Reference Examples 1 and 2 were produced. After that, on the primer layer 6 of the same substrate material film 5 with the applied primer layer, as that used according to the above described Practical Example 1, each of the above described coating process solutions, was reverse gravure coated by using a tilted line indented form, so that the coated amount was 6 g/m2, then this was dried and solidified, and especially, at a temperature of 100oC a thermal treatment was conducted for a period of 10 minutes, and by that the polishing tape 4, according to the Reference Example 1, was obtained.

[0033]

(Reference Example 2)

Water dispersible type polyester type varnish according to the composition shown in Table 1 and organo-silica sol material particles, with an average particle diameter in the range of 70 ~ 120 nm, were used as the main components, and by that the coating process solutions used for the preparation of the polishing layer according to the Reference Example 2 was produced. After that, on the primer layer 6 of the same substrate material film 5 with the applied primer layer, as that used according to the above described Practical Example 1, each o the above described coating process solutions, was reverse gravure coated by using a tilted line indented form, so that the coated amount was 6 g/m2, then this was dried and solidified, and especially, at a temperature of 100oC a thermal treatment was conducted for a period of 10 minutes, and by that the polishing tape 4, according to the Reference Example 2, was obtained.

[0034]

[Table 1]

Structural components of the polishing tapes according to the practical examples and the reference examples

試料 3		5 基材フィルム	プライマー 6		塗工液の組成 9 研磨材 10		バインダー 11		添加剤 17
	H 番号		種類 7	量 8 g/m²	種類 12	数量 13	種類 12	数量 13	
実施例 1	1	F1	延伸 16	0.3	A1	15	S1	15	—
	2	〃 15	延伸	0.3	A1	15	S1	15	硬 17
	3	〃 15	延伸	0.3	A1	15	S1	15	分 18
	4	F2	EP	1.0	A1	15	S1	15	—
	5	〃 15	EP	1.0	A1	15	S1	15	硬 17
	6	〃	EP	1.0	A1	15	S1	15	分 18
	7	F1	延伸 16	0.3	A2	18	S1	12	—
	8	〃 16	延伸	0.3	A2	18	S1	12	硬 17
	9	〃	延伸	0.5	A2	18	S1	12	分 18
	10	〃	延伸	0.5	A2	18	K2	12	—
	11	F3	EP	1.0	A2	50	B4	50	—
比較例 2	1	F1	16 延伸	0.5	S3	21	S1	9	—
	2	〃 15	延伸	0.5	S4	24	S1	6	—

Headings in the table:
1. Practical Example, 2. Reference Example, 3. Experimental material, 4. number, 5. substrate material film, 6. primer, 7. type, 8. amount, 9. coating solution composition, 10. abrasive material, 11. binder, 12. type, 13. dispersed amount, 14. additive agent, 15. the same, 16. oriented, 17. curing agent, 18. dispersant.

However, regarding the abbreviations and the symbols, they are according to the described here below. The additive agent is in a trace amount and that is why it is not included in the compounding ratios.

[0035]

F1: unoriented polyester film
F2: biaxially oriented polyester films
F3: low temperature shrinkage biaxially oriented polyester film
A1: mullite phase alumina - silica composite oxide particles, average particle diameter 50 ~ 700 nm
A2: mullite phase alumina - silica composite oxide particles, average particle diameter 70 ~ 120 nm
S3: organo-silica sol, average particle diameter 70 ~ 120 nm
S1: ceramic coat material
K2: silicone varnish
B4: water dispersible type polyester varnish
cure: curing agent
Disp: Dispersant
EP: epoxy type primer

[0036]

[Table 2]

Results from the evaluations of the Practical Examples and the Reference Examples

試料	番号	研磨材の塗工量 g/m²	研磨材：バインダーの比率	研磨層の特性 表面粗さ Ra μm	全光線透過率 %	ヘーズ %	研磨結果 仕上り精度	耐久性
実施例	1	9	50：50	0.40	50	85	○	◎
	2	〃	〃	0.40	50	85	○	◎
	3	〃	〃	0.30	80	80	○	◎
	4	6	〃	0.40	50	85	○	◎
	5	〃	〃	0.40	50	85	○	◎
	6	〃	〃	0.30	80	80	○	◎
	7	〃	60：40	0.05	85	50	◎	○
	8	〃	〃	0.05	85	50	◎	○
	9	〃	〃	0.05	85	50	◎	○
	10	〃	〃	0.05	80	55	◎	○
	11	30	50：50	0.05	83	60	◎	○
比較例	1	6	70：30	0.02	90	11	△	△
	2	〃	80：20	0.02	92	8	△	△

Headings in the table:
1. Practical Examples, 2. Reference Examples, 3. experimental materials, 4. number, 5. abrasive material coated amount g?m2:, 6. abrasive material: binder - ratio, 7. properties of the polishing layer, 8. surface roughness Ra (microns), 9. total light beam permeability (%), 10. haze (%), 11. polishing results, 12. finish precision, 13. durability properties, 14. the same.

Where, regarding the polishing results:

◎ : extremely good
○ : good
△ : there are some problems regarding the practical use properties, but it can be used

[0037]

Regarding each of the experimental materials obtained according to the Practical Examples and the Reference Examples, the final finish of the shown according to Figure 2 edge surface 11 of the optical connector ferrule of the optical fiber 2, was conducted, and as a result from that, in the case of the experimental materials

according to the Practical Examples 1 ~ 11, there were no polishing scratches or polishing spots at all, and the precision of the finish and the durability properties were good, and an operation at a good efficiency was possible, and an optical connector ferrule with good signal reduction properties, was produced. Contrary to that, in the case of the materials produced according to the reference examples, the same way as in the case of the materials produced according to the practical examples, the final finish of the shown according to Figure 2 edge surface 11 of the optical connector ferrule of the optical fiber 2, was conducted, and as a result from that, there was no generation of polishing scratches and polishing spots, however, they were tapes where the polishing efficiency and the durability properties of the polishing tape were approximately 80 % compared to the tapes according to the practical examples.

[0038]

Also, each of the experimental materials obtained according to the practical examples and the reference examples, were used in order to conduct the final finishing of precision part products, like semiconductor wafers, ceramics, color filters used for liquid crystal displays, plasma displays, optical glass, optical lenses, magnetic discs or optical discs substrate plates, magnetic heads, optical reading heads, etc., and the same final polishing was conducted as in the case of the optical connector ferrules. According to the obtained by that results, the same way as in the case of the optical connector ferrules, there were no polishing scratches and spots, and the signal dampening properties were good and it was possible to conduct the final finis at a good efficiency.

[Simple explanation of the figures]

[Figure 1]

Figure 1 is a figure that represents a summary diagram showing the sectional view of the structural components of the polishing tape laminated layer material.

[Figure 2]

Figure 2 is a figure that represents a sectional view summary diagram showing the state when the polishing film is placed on a pad.

[Explanation of the symbols]

1.....optical connector ferrule
2.....optical fiber
3.....covered part
4.....polishing tape
5.....substrate material film used for the polishing tape

[redacted]

6.....primer layer
7.....polishing layer

8.....elastic elastomer
9.....supporting material
11.....edge surface of the optical connector ferrule

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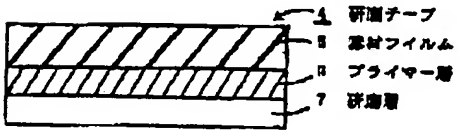
8/10/98

【図１】



【図２】